CLAIMS

1. Reactor vessel for performing a steam reforming reaction comprising:

- a vessel inlet for natural gas and steam,
- a vessel inlet for a hot gaseous medium,
- a vessel outlet for a gaseous product comprising the steam reforming product, and
- a reactor space comprising of a bed of steam reforming catalyst, which reactor space inlet is fluidly connected to the inlet for natural gas and steam and at its outlet end fluidly connected with the outlet for the gaseous product,

wherein inside the catalyst bed a passageway is provided fluidly connected to the vessel inlet for the hot gaseous medium for passage of hot gaseous mixture counter currently to the flow of reactants in the catalyst bed.

2. Reactor according to claim 1, wherein the reactor space is defined by one or more reactor tubes filled with a bed of steam reforming catalyst and wherein said reactor tube comprises one or more passageway(s) running parallel to the axis of said reactor tube.

3. Reactor according to claim 2, wherein the steam reforming product exiting from the reactor tube, the vessel hot gaseous medium from its vessel inlet are both in fluid communication with the inlet of the passageways such that in use a mixture of hot gaseous medium and the steam reforming product passes said passageway.

4. Reactor according to any one of claims 1-3, wherein the passageway is a tube made from a metal alloy, wherein the metal alloy comprises from 0 and up to 7 wt% iron,

between 0 and 5 wt% aluminium, from 0 up to 5 wt% silicon, from 20 up to 50 wt% chromium and at least 35 wt% nickel, wherein the nickel content balances the total to 100%.

5. Process for the preparation of hydrogen and carbon monoxide containing gas from a carbonaceous feedstock by performing the following steps:

(a) partial oxidation of a carbonaceous feedstock thereby obtaining a first gaseous mixture of hydrogen and carbon monoxide and

(b) catalytic steam reforming a carbonaceous feedstock in a Convective Steam Reformer comprising a tubular reactor provided with one or more tubes containing a reforming catalyst, wherein the required heat for the steam reforming reaction is provided by convective heat exchange between the steam reformer reactor tubes and a passageway positioned within and along the axis of the tubular reactor tubes through which passageway the effluent of step (a) flows counter-current to the gasses in the steam reformer tubes.

6. Process according to claim 5, wherein the gas velocity in the passageway is between 10 and 60 m/s.

7. Process according to any one of claims 5-6, wherein between 0 and 60 wt% of the steam reformer product as obtained in step (b) and the effluent of step (a) flows through the passageway.

8. Process according to any one of claims 5-7, wherein the H_2/CO molar ratio of the combined synthesis gas product of step (a) and (b) is between 1.5 and 3, preferably between 1.9 and 2.3.

9. Process according to any one of claims 5-8, wherein the steam to carbon molar ratio of the feed to step (b) is between 0.5 and 0.9.

10. Process according to claim 9, wherein the reforming catalyst comprises (a) an oxidic support material and (b) a coating comprising between 0.1 and 7.0 wt% of at least one of the metals of the group consisting of Pt, Ni, Pd and Co, preferably platinum; said support material comprising: (i) at least 80 wt% of ZrO_2 which has been calcined at a temperature up to about 670 °C before the application of said coating; (ii) 0.5-10 mol% of at least one oxide selected from the group consisting of Y, La, Al, Ca, Ce and Si, preferably La_2O_3.

11. Process according to any one of claims 5-10, wherein the temperature of the metal wall surfaces of the passageways in step (b) is maintained below 1100 °C.

12. Process according to any one of claims 5-11, wherein the steam reforming product of step (b) is fed to step (a).

13. Process according to claim 12, wherein the steam reforming product of step (b) is fed to the upper half of a partial oxidation reactor vessel, said vessel provided with a burner at its upper end, and wherein the temperature in the upper half of the vessel is between 800 to 1050 °C.

14. Process according to any one of claims 12-13, wherein the mixture of the steam reformer product of step (b) and the product of the partial oxidation reaction of step (a) is subjected to an autothermal reformer step (c).

15. Process according to any one of claims 5-14, wherein hydrogen is recovered from the effluent of step (b).

16. Process according to any one of claims 5-15, wherein step (b) is performed in the reactor vessel according to any one of claims 1-4 of the present invention.